

AIR WAR COLLEGE

AIR UNIVERSITY

AIRCRAFT MAINTENANCE ENABLED
JOINT CONCEPT FOR ENTRY OPERATIONS

by

Rognald E. Christensen, Lt Col, USAF

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Advisor: Col Daniel Runyon

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Introduction

In Major General Brown's "Untethered Operations" article, he describes a NATO airfield coming to life in a few short hours, a lone C-17 taxiing onto the airfield and equipment and personnel pouring off the cargo ramp to quickly set up operations for an inbound 4-ship of F-16s. After successfully rearming, fueling and accomplishing any required maintenance, the 4-ship departed within two hours for the next mission and the C-17 departed for the next mission generation stop.¹ The "Untethered Operations" concept was formed to break out of the U.S. Air Force's decades old paradigm of fighting from a well-established or at a minimum a well-resourced air base. The air base was looked at as a weapons system in and of itself, and assumed a large degree of force protection and impunity from attack. A platform from which large amounts of sustained sortie generation would be projected from and into the fight. The "Untethered Operations" concept is designed to help planners who face difficult anti-access/area (A2/AD) denial battlefronts. While this is a great concept, more must be done to reduce the logistics footprint, improve logistics agility and reduce costs of logistics operations. Logisticians must always find a way to enable the operations that our Services require.

Thesis

From the airpower that General Pershing used in WWI through today's conflicts, the Air Force has fought to improve our expeditionary mindset. As an aircraft maintainer and in the larger context, as a logistician, it is my duty to enable agile, flexible and persistent airpower through effective mission generation. Over the years, many improvements to logistics have moved aircraft maintenance and the larger umbrella of Agile Combat Support towards the goal of affording airpower the ability to be in the fight "any time at any place". Today's challenge of

multi-domain warfare and A2/AD environments require more innovative thinking. Much work has been accomplished in quickly moving people and equipment rapidly around the globe to present fighter forces in a manner that exploits the enemy's inability to target everything at once. I believe flexibility and speed in mission generation can be accomplished if aircraft maintenance manpower can be better utilized through a 21st century version of Rivet Workforce that combines Air Force Specialties (AFSs) in groups such as Fighter, Bomber or Airlift. By leveraging investments in education and training, the Air Force will bring even greater flexibility to operational planners that seek to widely distribute operations and have the ability to rapidly move them in a sustainable manner.

Narrative Section Title

Airpower Doctrine

United States Air Force airpower is designed, planned, conducted and assessed according to an effects-based approach. This approach dictates that operations are driven by desired ends (end states and objectives). It also emphasizes that the problems that commanders within the Air Force face are interactively complex and not solvable by deterministic or “check list” approaches.² Additionally, the principle of Flexibility and that of Persistence contained within Air Force doctrine are especially salient to today's challenge of fighter mission generation. Flexibility allows airpower to shift from one campaign objective to another, quick and decisively. B. H. Liddell Hart exclaimed, “Air Forces can be switched from one objective to another. They are not committed to any one course of action as an army is, by its bulk, complexity, and relatively low mobility. While their action should be concentrated afresh against other objectives, not only in a different place, but of a different kind.”³ This quote,

which is featured so prominently in Air Force Doctrine re-enforces the idea of moving combat airpower quickly and effectively, which is markedly different than moving from target to target. The former involves relocating aircraft, personnel and sortie generation and support assets to another airfield, whereas the latter often involves the placement of ordinance or a combat effect that can usually be accomplished within the combat radius. This principle of flexibility and the ability to quickly and effectively shift sortie generation operations to alternate airfields enables the principle of persistence.

Persistence in the form of Airpower affords the United States the capacity to conduct operations continuously against a broad spectrum of targets. Due to the nature of Airpower's innate speed and range, it can visit and revisit targets with near impunity. Airpower does not have to occupy the terrain of the battlefield in order to apply force to the enemy. This ability denies the enemy access to the battlespace and ensures friendly forces can operate in the area.⁴ In order to facilitate persistence, Airpower must project power from airfields or bases within striking distance. Advanced militaries now have the ability to employ effective defenses and hold these airfields and airbases at risk with long-range strike weapons that can render friendly runways and airbases ineffective. This long-range strike capability strengthens the need for Airpower to have the ability to quickly shift from base to base or airfield to airfield. Rapid and effective mobile Combat Support is an effective capability; however, it currently presents a significant transportation challenge as the mobility footprint is significant (multiple C-17s required) to move personnel and equipment to alternate airfields.

“Combat Support enables operations in peacetime and wartime with effects supporting US national interests at any time or place across the range of military operations.”⁵ The key verbiage in the above excerpt of the Combat Support Annex of Air Force Doctrine is idea that it

supports operations “any time or place”. Another important principle of Combat Support is the ability to employ this support with minimal forward footprint. This can be implemented effectively with the Air Force’s considerable global mobility and the use of reach back. Rapid reach back ensures that assets that are required, but were not initially allocated, are moved into theater immediately. Finally, effective Combat Support provides the ability to rapidly deploy from home station and transition between operational requirements (move from airfield to airfield).⁶ The ability to accomplish this feat is predicated on mission generation support being sized, trained and equipped to rapidly move or accept employing air power forces.

The Air Force’s core capability of Combat Support is “Generate the Mission”. This involves preparing, configuring, launching, recovering and regenerating weapon systems and payloads. Mission generation supports the “Employing the Force” core process which provides right-sized support and timely regeneration. This is also quickly followed by the core process of “Sustaining the Force” which endeavors to maintain effective levels of forces and materiel for ongoing operations.⁷ So what is meant by “maintain effective levels of forces and materiel”? Air Force Doctrine gives a clue when it states, “repair and maintain addresses the assessment, repair, maintenance and modification of materiel.” Today, each weapon system has a dedicated workforce assigned to maintain it. As an example, the Air Force specially trains maintenance personnel to repair F-22, F-16, F-15, etc. In order to rapidly move airpower within a combat theater, these maintenance personnel must deploy with the weapon system. Operational units cannot simply land various weapon systems at airfields already staffed with alternate weapon systems (i.e., F-16 aircraft cannot re-orient to another air force base that contains F-22 personnel and utilize the organic maintainer’s equipment or technical data). This limitation restricts air planners from fully employing the principle of Flexibility. However, doctrine also suggests that

“Combat Support forces should aggressively seek and apply innovation and creativity” and it charges the Director of Logistics (A4) on the Air Force staff with oversight of this area.⁸ The question is, where within the vast A4 enterprise do you begin to solve this limitation? The answer could lie within specialty classification along with the education and training sphere.

In fact, doctrine once again points us to a place to start. Annex C of USAF Basic Doctrine asserts that education and training facilitate the transition from one level of experience to the next. It also states that skills training and developmental education are foundational to preparing Airman and that choosing the proper approach is critical. The key, according to Annex C, is that recognition of the distinction between them is essential as training approaches applied to education are less effective as well as the inverse. Therefore, a thorough examination of the approach in which the Air Force classifies (into specialties) and then educates and trains its aircraft maintenance personnel seems appropriate.

Mission Generation and Combat Logistics

The USAF is built to supply combatant commanders with, among other combat effects that of Airpower. Within the sustainment community, the generation of combat power is delivered on airfields across the globe by a highly trained and agile force of aircraft maintainers. AFI 21-101 Aircraft and Equipment Maintenance Management, lays out the framework when it states, “Organizational and intermediate-level maintenance is organized into two mutually supporting networks, the Mission Generation Network (MGN) and the Repair Network (RN). The MGN is optimized for mission generation at the wing level and consists of authorized “on-equipment” and “off-equipment” maintenance capabilities required to launch, recover, configure, inspect and repair AF systems and equipment. The RN supports the MGN by providing

maintenance required to fulfill operational needs outside the capability and/or capacity of MGN activities.”⁹ This MGN supports both peacetime / steady state and combat logistics needs of the supported commanders.

There are two significant and important differences between combat and peacetime / steady state operations. The first is determined fiscal realities. During peacetime or steady state operations, efficiency and fiscal matters are restrictive, whereas in times of war, military budgets increase dramatically and logistics leaders are less concerned with half empty cargo ships than they are with re-supply speeds. Secondly, there is a fundamental difference between the nature of the operations during combat and peacetime. Combat often means that an enemy is trying to disrupt logistics operations and logisticians must design flexible alternatives to satisfy combat imperatives such as, geographic movement, mobility and reduced signature operations. For combat operations, there is a constant requirement to make logistics and mission generation more flexible, with a smaller footprint in order to keep pace with war-time tempo and operational flexibility.¹⁰

As war has become a near constant for the American military since the events of 9/11 and for the USAF since the first Gulf War, the leaders of the U.S. have had to restrain combat funding to ensure enduring commitments. This led civilian and combat leaders to make the undesirable choice between more combat capability or the ability to sustain combat logistics. Leaders tend to prefer more combat capability to less and are always looking for more of it, which means that logistics must be sacrificed when fiscal constraints are applied to military operations. Additionally, as military equipment becomes more complex, the sustainment costs associated with this new equipment has increased as well. For instance, in WWII, the Air Force would employ X bombers, and Y bombs to destroy a target. This was accomplished with a

relatively light logistics tail. Today, a modern fighter can engage the same target with extraordinary precision, yet this advanced aircraft has a larger logistics tail, and is usually supported by ISR aircraft, escort aircraft, and ground SOF units, that all have their own logistics tails. The question planners today must ask is if this new capability, that requires more combat logistics, is worth the “bang for the buck”. If the answer is “yes” then how can combat logistics cost be reduced? There are several ways to do this; to include, 1) living off the land 2) speed delivery of logistics 3) regulate the tempo of operations and 4) replace aging weapon systems with new technology.¹¹ The military has accomplished many innovations in logistics today, to include refining and speeding logistics when needed and investing in technology. The only area that logistics can still influence without degrading operations is the “living off the land” concept that in today’s modern war translates into pre-positioned stocks, or a wider use of in-place assets. Before a solution is proposed, I believe a deeper understanding of how logistics has evolved is necessary. What truly drives the logistics requirements?

Legacy Logistics

While education and training are foundational, logistics requirements often drive how maintenance is performed. In fact, logistics has been a factor in the use of airpower since its first use back in 1916 when Brigadier General John J. Pershing used aircraft while pursuing Poncho Villa in Mexico. General Pershing discovered then what is largely still the case today, that aircraft require dedicated support when operating at a distance from major maintenance facilities. To further refine the challenge of expeditionary airpower, an American Airman wrote of four issues that plagued the Expeditionary Air Force (EAF) during WWI. The four factors that required immediate attention were: 1) geography (operating 3,000 miles from the U.S.) was

difficult 2) conducting operations in foreign lands is problematic due to diplomatic relations, airfield and port access, and logistical challenges of forward deployed operations 3) communications were constricted and 4) the U.S. deploys our airpower to make up for shortages of the host nation.¹² These factors still confound airpower planners today and as items 1 and 2 demonstrate, logistics and aircraft maintenance are important components to an executable deployment.

If WWI was a challenge logistically, WWII, which was fought on a truly global scale challenged logisticians and logistics planners on a monumental scale. Many of the things we take for granted now were very difficult in the Pacific theater. Unlike Europe, the Pacific was vast and contained many logistics challenges. U.S. TRANSCOM did not exist, and the movement of supplies was shared by the Navy and Army and coordination was difficult. For the U.S. Army Air Force, it dealt with clumsy logistics command and control, highly complex geography, intra-command competition, manpower shortages and infrastructure and equipment problems. The complexity of logistics operations in Southwest Asia during WWII, offers a glimpse into the considerations planners must deal with, and shows airpower's flexibility to overcome. For example, as part of General MacArthur's island hopping campaign in New Guinea, the Allies required "the movement of a large portion of supplies by hand along the Kokoda trail. This trail was composed of a 145-mile trek between the Australian-held town of Port Moresby and the Japanese stronghold of Buna that extended over the Owen Stanley Mountains. Just wide enough for one man in most places, supplies for both the Allies and the Japanese moved along the trail at an agonizingly slow pace. Allied resupply trips took up to eight days for journeys along the Kokoda trail. Native laborers carried loads between 40 – 70 pounds and crossed the mountain range through high passes at 7,500 feet in altitude." This

extraordinary, but not unique problem to this theater was solved by, “airmen dropping 25 tons of supplies daily on the Kokoda trail to support the Australian Division on the trail...this number increased to between 100 to 150 tons daily.”¹³

History can also teach us about the first successful employment of expeditionary forces in which expedience was planned from the onset and executed with efficiency. In essence, this historical example best describes the principle of Flexibility in today’s Air Force Doctrine. In the 1950s, Tactical Air Command began work on what would come to be called the Composite Air Strike Force (CASF). The CASF was developed as a quick response force that could deploy on short notice to bases with minimal facilities. The CASF would be able to sustain combat operations with minimal resupply for a period of at least 30 days.¹⁴ This concept was proven when in July of 1958 the CASF was deployed and operational in 13 days when tasked to provide airpower to Lebanon from Turkey. It was additionally tasked 30 days later to intervene on behalf of Taiwan, and arrived in a mere 96 hours in the Pacific theater. Both operations were deployed quickly and lasted around 100 days. Both operations also succeeded in accomplishing their mission. In the late 1950s, combat airpower demonstrated both flexibility and agility. The pre-staging of maintenance equipment, fuel, bombs and vehicles validated the concept of pre-positioned stocks and ultimately made the CASF successful. The CASF enjoyed access to over 51 overseas locations. Today our Air Force has access to approximately 20 air bases overseas.¹⁵ We no longer have the ability or the funds to simply place modern equipment all over the world in the hopes that we might use it. Equipment is only a portion of the logistics challenge and in the case of aircraft maintenance personnel, their training and skillset are a large if not the most significant factor in deployed airpower operations.

Autonomic Logistics (New approach to aircraft repair)

Logistics, along with its critical subcomponent aircraft maintenance, is currently being transformed through automation and advanced diagnostic and prognostic fleet health management. Aircraft designers and Air Force acquisition and sustainment personnel set a goal from the beginning of 5th generation aircraft design to build a smart and reliable aircraft in addition to one that met the required performance specifications. The transformation began with the entrance of the F-22 Raptor and the incorporation of supportability into the design of the aircraft system. The designer, Lockheed Martin, worked with maintainers, designers and manufacturing representatives to ensure that each part or system had a high degree of maintainability in addition to highly reliability while the aircraft was in development.

However, maintainability was only one portion of the F-22. It also incorporated advance fault detection and isolation and self-sufficiency. Fault detection, also known as build-in-test (BIT) is not new to fighter aircraft, however the F-22 incorporated a vast network of BIT sensors throughout the aircraft to give the F-22 maintainers fault isolation resolution down to the line replaceable module or circuit card. This dramatically reduces the amount of time a maintainer must use to troubleshoot the problem. Along with the advanced fault detection, the Raptor is loaded with self-sufficient systems such as On-Board Oxygen Generating System and Nitrogen generating system, which removes the requirement to service the aircraft with liquid oxygen and gaseous nitrogen. It also contains a fully capable Auxiliary Power Unit (APU), that provides power, air and hydraulic pressure systems, eliminating the need for ground power, air or hydraulic carts. These inherent systems enable the maintainer to work smarter, reducing maintenance repair times, in addition to reducing the deployment footprint of both personnel and

support equipment. The F-22 and its Integrated Maintenance Information System (IMIS) brought about the era of the technology equipped maintainer.

IMIS integrated technical order data, aircraft forms and the aircraft diagnostics into one system that are all contained on a Portable Maintenance Aid (PMA). Gone are the days of dragging volumes of technical orders, job guides, fault isolation trees and parts breakdown manuals. The PMA has all required technical data at the maintainer's finger tips, along with the aircraft forms required to document aircraft status and completed repairs, that are electronically shared across all maintenance work centers. The days of "running down" forms (literally running from work center to work center across the vast maintenance complex) before a job could start are now a thing of the past thanks to IMIS, so in the Raptor's case, you get "fast and good", in that the speed of maintenance is accelerated in a way that ensures high quality.¹⁶

While the introduction of the F-22 ushered in the era of intelligent aircraft and technology equipped and supported maintainers, the F-35 is moving beyond and revolutionizing maintenance and logistics on a global scale. The Joint Strike Fighter (JSF) introduced the concept of Autonomic Logistics. Autonomic response is a subconscious reflex and provides a timely reaction to a problem with the human body. According to Lockheed Martin, Autonomic Logistics (AL) is a "seamless, embedded solution that integrates current performance, operational parameters, current configuration, scheduled upgrades and maintenance, component history, predictive diagnostics (prognostics) and health management, and service support into the F-35 air system."¹⁷ The maintenance system has now moved beyond the diagnostic based systems of the past (including F-22) and now include prognostics, which helps prevent failures before they occur. This capability is also integrated into the scheduling portion of AL to make

the best use of downtime which considers the aircraft's configuration (modifications and upgrades) along with planned improvements and future based maintenance events.

This highly complex web of networked information is managed and manipulated in the Autonomic Logistics Information System (ALIS). ALIS is a system of systems which, among other things, "captures and analyzes aircraft condition data from the F-35, supporting fleet operations, maintenance, fault-prediction and supply chain management."¹⁸ This sounds amazing, but what is the goal of all of this automation besides improved maintainability and to a greater degree, supportability? For decades, the defense industry in the U.S. has touted that new fighters require less maintenance due to technological advances. Congressional research has actually proven the opposite to more closely resemble the truth. The F-35 program, which is a combination of industry and a government program office, is counting on the fusion of two new platforms to reverse this trend. The program has combined an embedded Health & Usage Monitoring System (HUMS) with ALIS to create "perhaps the most advanced and comprehensive set of diagnostic, prognostic, and health management capabilities yet to be applied to an aviation platform."¹⁹ The need for this fusion comes from the inherent problems with new aircraft. Escalating complexity in electronics, engines, wiring and other systems delivers radical and game changing new capabilities. However, each new capability represents an individual failure point. As the mature capabilities reliability rises, the aircraft's overall reliability is only as good as its worst performing system or part.²⁰ Therefore, ALIS will utilize HUMS data from each flight to improve the world-wide fleet of F-35s and not just one aircraft. This concept holds to a promise of advanced logistics that will open the door to new possibilities in deployed fighter operations which will benefit from a global management standpoint.

Deployments cannot happen before a well-trained maintenance force is prepared to harness the benefits of AL. The F-35 has also attempted to transform training by integrating the computing power and technology driven aircraft into the training environment. The National Training Center (NTC) at Eglin AFB, FL is the center of excellence and schoolhouse for all initial JSF maintenance training. The training heavily incorporates ALIS and simulation in order to remove the burden of on-aircraft time associated with most weapon systems. Nearly 95 percent of all training at the NTC is either computer-based or accomplished with maintenance simulators.²¹

Maintenance Structure, Training and Certification

One of the most easily recognizable changes in aircraft maintenance and in the ability to efficiently generate sorties has been in the structure of the organization responsible for mission generation. Beginning with WWI, the flying squadrons and their commanders were given responsibility for “upkeep and repair” of all aircraft assigned to them. The squadron was designed to be expeditionary as stated earlier and was not to be bogged down with heavy equipment that would limit its ability. The organizational concept was one of decentralized maintenance utilizing maintainers that were experts on the entire aircraft, as aircraft were fairly unsophisticated.

However, as aircraft evolved in sophistication and complexity, the maintenance organization that was required to deal with this complexity evolved as well. New processes required to repair and fabricate items such as metal tubing and pressed metal structures, along with the decision of when to induct aircraft into overhaul (depot maintenance), having moved from the local engineering officer’s assessment to a flying hour based approach, led to a centralized maintenance concept by WWII.²²

Since WWI, aircraft maintenance organization has changed fairly regularly and shifted between centralized and decentralized constructs. The 1970s brought about the idea of decentralized execution with centralized control, based on the Israeli Air Force's performance in the Yom Kippur war, until General Wilbur Creech introduced the Combat Oriented Maintenance Organization which emphasized increased execution with less centralized control. By 1990, mission capable rates had increased to an all-time high of 88.4 percent. Some gave credit to the most recent change in organizational structure, however the most likely reason for the improvement was the introduction of newer, more modern, more reliable aircraft and better technical repair data. Additionally, the aircraft maintenance community was full of highly skilled Airman that were transitioning to aircraft with much higher degrees of maintainability.

True to form, the Air Force reorganized two additional times from the 1990s Objective Wing construct (in which sortie generation maintenance was aligned within the operational squadrons and off equipment was organized into the Logistics Group) through 2005 to arrive at our current organization titled the Combat Wing Organization, in which a Maintenance Group is responsible for all maintenance actions in order to properly balance sortie production and fleet health on an ever-aging fleet of aircraft. The history of organizational changes within the maintenance areas have often been in response to budgetary, resource (usually personnel), and technology.²³ Analysis has not proven which, if any, specific organization best supports mission generation, however, as described above, newer aircraft with improved maintainability designed into the aircraft have changed how the Air Force has classified and certified its maintainers.

In 1985, the Air Force divided its 135,000 aircraft maintainers into 43 distinct job categories called Air Force Specialties (AFS) with an additional 60 further subdivisions, often referred to as "shreds" or "shred outs". The growth and complexity of technologically

sophisticated aircraft led to a growth in the number of AFSs required to ensure mission generation. A typical 72 aircraft Fighter Wing demanded nearly 1,800 maintainers made up of over 25 AFSs. As the Air Force was developing what would become the EAF, the requirement for flexibility arose since the goal was to fight from many dispersed locations in much smaller units than the typical 12 to 24 ship units of the day. This concept required more manpower with the AFS construct of the time, yet logistics simulations also showed that sortie rates equal to large consolidated units could be achieved with fewer maintenance personnel if cross-utilization among AFSs was utilized. All of this pointed to a requirement to change manpower, personnel and training (MPT) policies.²⁴ The plan the Air Force devised in the 1980s was called “Rivet Workforce”. The plan laid out 5 guiding principles for the eventual redefinition of maintenance AFSs: 1) group tasks to “on-equipment” or “off-equipment”, 2) “on-equipment” restructuring will remain weapon system specific while “off-equipment” restructuring will not be tied to specific weapon systems, 3) reducing of “on-equipment” specialization will have the greatest impact as they represent the bulk of deploying forces, 4) changes to AFSs must be judged to be workable from a task skill/learning standpoint and be supportable through Air Force personnel training systems, 5) all MAJCOMs must participate, recognizing the differences in missions and equipment.²⁵ Today this endeavor can be seen in the way new fighter aircraft are introduced into the active inventory. The F-22 and F-35 have reduced the “on-equipment” AFSs to a mere three specialties (as opposed to 4th generation aircraft which employ at least six); Crew Chiefs, Weapons, and Avionics. The legacy AFSs of propulsion, electrical/environmental and hydraulics have been removed from “on-equipment” work centers. The “off-equipment” AFSs have been reduced as well. Gone are the backshops of Electrical/Environmental, Hydraulics, Avionics, and Armament. The 5th generation aircraft and the technology that comes with them

have afforded changes called for in the Rivet Workforce plan. Much of the reduction in “off-equipment” repair workload was shifted to a contractor operated repair network that quickly moves “broken” parts from the flightline to Original Equipment Manufacturers (OEMs) for repair and return into the supply system. Organizational structure is often the most discussed aspect of mission generation when it comes to improvement or efficiency. Training and Certification also play a large role in how the manpower of the “logistics tail” is shaped.

Maintenance training has evolved over the years along with the aircraft. The Air Force demands highly skilled and competent maintainers. Why? In order to produce safe and available aircraft and support equipment, skilled maintainers must be managed throughout the spectrum of technician capability. This program must be based on a certification of tasks that are based on the maintenance program that then supports the employed weapons systems.²⁶ At its essence, maintenance training needs are identified by, “comparing the tasks required to the capabilities and skills of the existing work force.” In other words, if you are ensuring that a correlation exists between the tasks required to repair and maintain the equipment (aircraft and support equipment) and the abilities and knowledge of the maintenance technicians your training program should meet your needs.²⁷ In addition to training, certification is important.

Certification documents that the technician has shown the competency to perform the task. At the minimum, each work center or location requires at least one technician qualified to perform each task that has been identified in the maintenance plan. A maintenance plan is “a more detailed description of maintenance decisions on each repairable item candidate within the system...there typically are a family of maintenance plans covering each major subsystem, e.g., the radar subsystem and hydraulic subsystem.”²⁸ In other words, each aircraft or major end item that is procured has a detailed task list for technicians at each level of repair. This is important

because it identifies who, and what gets repaired and at which level of maintenance, i.e. field or depot level. At the wing level, the maintenance tasks are performed at the field level (flight line or organizational) with some maintenance occurring at the intermediate (back shop), however the trend in new aircraft design is to focus on the flight line or depot, removing intermediate level maintenance to minimum levels.

The Air Force uses the certification and training requirements to develop specialties known as Air Force Specialties (AFS). It breaks these specialties down into codes known as AFSCs. Each AFS has a Career Field Manager (CFM) that annually conducts Utilization and Training Workshops to “develop and review life-cycle AFS performance and training requirements” in addition to “determining AFS training tasks, requirements and resources.”²⁹ The important fundamental approach that should be taken is one that “trains and certifies people on logical groups of tasks and plans for how many people at each skill level are required to have enough people for each task.”³⁰ This process is reviewed within each AFS by the CFM annually. However, a broader view is often required and has been accomplished in years past. According to a Rand report, “Consolidating aircraft maintenance job categories, called AFSs is not a new idea...the Air Force underwent a major effort to consolidate the number of maintenance AFSs in the 1980s and 1990s as part of the Rivet Workforce initiative.”³¹ Perhaps now is the time for another look at Rivet Workforce as the newer fighter fleets, the F-22 and F-35, required fewer AFSs and bring with them an advanced sustainment capability which simplifies and streamlines aircraft repair. Why now? The answer lies with the need for new operational concepts such as: micro-basing, Rapid Raptor, and USAFE’s Untethered Operations, which in turn will require a new sustainment models.

Logistics of Forward Basing – New Ideas, Old Problems

As stated earlier, expeditionary operations and the need for this capability is not new and has been evolving over time. Paul Killingsworth accurately described the challenge in 2000 when he wrote, “perhaps the greatest challenge the Air Force faces in becoming more expeditionary is overcoming the traditionally heavy nature of its support processes and equipment.” He later identifies, “the biggest payoffs will be achieved by examining the strategic decisions that must be made long before the deployment takes place...of which those regarding forward infrastructure as critical to projection of aerospace power.”³² His analysis in 2000 pointed to the need to move beyond Forward Operating Locations (FOLs), Forward Support Locations (FSLs) , and Core Support Locations and proposed the idea of an air mobility network that could move required sustainment support rapidly through the system of FOLs and FSLs aptly named Flexbasing. All of this would additionally require an advanced logistics command and control system that reacted swiftly to rapidly changing operational requirements.³³

Flexbasing and its inherent elasticity supports the current Joint Concept for Entry Operations (JCEO), which states, “The aim is to employ opportunistic and unpredictable maneuver in and across multiple domains, establishing local superiority at multiple entry points to gain entry and achieve objectives.”³⁴ The ability to rapidly maneuver our fighter forces in today’s multi-domain threat environment is the catalyst behind Rapid Raptor, Micro-basing and Untethered Operations. Micro-basing attacks many of the problems addressed in the JCEO by “spreading the field” and presenting a battlefield too diverse for effective adversary attack. It also drives planners to bases that easily support logistics operations with well-established ports and military facilities.³⁵ Rapid Raptor took the concept one step further by opening up the basing concept by marrying F-22s with a single C-17 that carried personnel, munitions, weapons and fuel. Advancing on the Micro-basing concept, Rapid Raptor solved the inherent logistics

issues, however the size and scope of these operations are limited to what could be carried on one C-17 and it assumes availability of C-17s, which become a premium asset during wartime for TRANSCOM.³⁶

Enter Untethered Operations, a concept that “depends upon light logistics and forward basing to offer increased agility to fighter operations.” This concept accurately identifies the fighter requirements of a minimum of: a runway, fuel, munitions, support equipment, spare parts, and the support personnel to operate them.³⁷ It seeks to establish a massive network of airfields that have re-fueling capability that further reduces the logistics requirement. Finally, by leveraging the massive network of bases in Europe, Untether Operations seeks to reduce the airlift requirement by leveraging the interconnected roadways and in place ground logistics networks. With this concept, we’ve now reduced the logistics footprint for airlift by reducing the need to transport fuel and using ground transport for spare parts, munitions and equipment. The one area that none of these concepts adequately address is that of support personnel. If a way could be found to reduce the number of support personnel required to move with the aircraft, the flexibility of fighter operations would be increased even more than Rapid Raptor, Micro-Basing and Untethered Operations currently offer. How might that be accomplished? The answer might lie in a version of an initiative from our past.

Rivet Work Force 2020 - The Past and the Possibilities

Rivet Workforce reduced the overall number of AFSs through consolidation amongst the entire spectrum of maintenance AFSs. For instance, Sheet Metal and Corrosion Control were combined into the Structural Maintenance Career Field. Additionally, as stated above, newer fighter platforms, such as, F-22 and F-35 have reduced the number of AFSs required to maintain

them through a combination of improved sustainment technology and an advanced repair network. Sustainment information systems such as F-22's IMIS and the F-35's ALIS streamline maintenance repair operations and reduce the workload on maintenance personnel. The current Air Force Enlisted Classification Directory consists of 359 pages of AFSs and lists hundreds of aircraft maintenance AFSCs. For fighter Crew Chiefs alone there are two AFSs, 2A3x3 Tactical Aircraft Maintenance, and 2A3x7 Tactical Aircraft Maintenance (5th Generation). The former includes the A-10/U-2, F-15 and F-16 airframes, whereas the latter includes the F-22 and F-35.³⁸ Based on this AFS system, operational planners would need to consider 5 separate personnel types (one for each mission design series: F-15, F-16, A-10, F-22, F-35) for the Crew Chief specialty alones when planning Joint Concept of Entry Operations (based on missions similar to Untethered Operations) due to the 5 types of fighter available today. The problem set becomes even more pronounced when the additional flight line and mission generation AFS's are applied. The personnel problem set of forward presence and rapid flexibility presents an opportunity to share maintenance capability across maintenance AFSs.

This portends another question, what is the standard when devising the AFS structure? According to AFI 36-2101-Classifying Military Personnel, the classification system "groups related work requirements (positions) into Air Force Specialties (AFS). Positions are grouped on similarity of functions and requirements for knowledge, education, training, experience, ability, and other common criteria." Based on this broad definition, I believe it is possible to further converge specialties similar to the Rivet Workforce initiative, however this time we should look to group maintenance AFSs by airframe type instead of airframe specific. In other words, it might be time for a Fighter, Bomber, ISR or Airlift AFS grouping. For instance, as stated above we could group all 5 fighter Crew Chief AFSs into one. This could also be done for the

remaining flight line based AFS (avionics and weapons). This would require additional training and management, especially in the entry level technicians, however, when applying this concept to JCEO type problem sets, it would allow maximum flexibility. Fighter personnel could be utilized across the fighter network, instead of moving them from the limited number of bases from which they now project sustainment forces. Imagine a network of bases across the Pacific or Europe that had small pockets of “Fighter” AFSs, manning micro-bases and being moved around with minimal airlift. In a 2016 RAND study, analysis indicated that AFS consolidation has the potential in the long run to both reduce manpower (sustainment) costs and improve readiness. This study points to the requirement that training above all else must adapt to enable this change and it must provide the same capability (depth and knowledge and skill) as today’s AFS structure does.³⁹ This concept has the potential to tackle what is most likely the last hurdle towards true agility for the Air Force’s fighter operations when facing an advanced threat scenario in a highly contested Joint Entry Operation. Amazingly there is some precedent for it that has been in place for a long time. Within the weapons AFS, each combat wing maintains a LSC (Load Standardization Crew) within the Group that among other things certifies each unit’s Squadron Lead Crew. The LSC is afforded the ability to load weapons on transient aircraft that the local weapons crews are not certified to load. This concept, if expanded is very similar to my proposed solution. As with all endeavors, appropriate risk and benefit analysis will be required, however, innovative solutions are sometimes right in front of us, and merely need to be tested or fleshed out. Risk should be dramatically reduced with today’s advanced automated maintenance and logistics systems. Perhaps modification of our maintenance AFS coupled with the fielding of technology based aircraft can dramatically change the mission generation equation and give planners more flexibility for today’s wicked problems.

Consolidation of AFS is not without controversy. To be sure when the original Rivet Workforce plan was implemented 30 years ago, many were concerned that consolidation would reduce the level of expertise needed for repair of the weapon systems of that time. Both the Air Force and Navy have grappled with the benefits of consolidation versus the reduction of specialization in their aircraft maintenance manpower systems. However, Rivet Workforce appears to be successful nearly 30 years into the consolidation and the F-22 has clearly demonstrated how a further consolidation of AFS, combined with advanced troubleshooting and automated maintenance can prove successful in maintaining sortie generation capability and lowering maintenance manpower costs. The improved automation and intelligent troubleshooting capabilities of the F-35 will open new possibilities into maintenance manpower utilization changes. The Air Force would be wise to take advantage of this opportunity.

Conclusion

Air Force Doctrine challenges planners to not fall into a “checklist” approach when devising the employment of airpower. In order for the Air Force to plan and execute operations based on the JCEO a lighter, more effective and cheaper logistics model is required to enable conceptual operations in the spirit of Micro-basing, Rapid Raptor and Untethered Operations. One possibility is to take a 21st century approach to manpower consolidation on a scale similar to what Rivet Workforce accomplished in the 1980s and 1990s. A consolidation based on aircraft type, such as, Fighter, Bomber, ISR or Airlift would give operational planners the needed flexibility for executing sustained airpower operations in contested battlefronts. This consolidation can be enabled through investments in additional and evolutionary training and certification program within the aircraft maintenance career fields. RAND analysis has

demonstrated that AFS consolidation has the potential to both decrease sustainment costs and increase aircraft availability which translates into additional combat power for our combatant commanders. Many innovations begin with radical concepts or ideas, this has the potential to make our Air Force more effective in today's increasingly difficult forced entry operations. Careful study should precede any changes, to include refined estimates on training requirements, sustainment technology improvement for 4th generation aircraft and possible impacts on accession and promotions of affected aircraft maintainers. Aircraft maintenance must evolve, and with today's sustainment technology, aircraft maintainers can take the next step in improving Agile Combat Support for airpower.



Notes

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⁴ Ibid.

⁵ “Air Force Doctrine - Combat Support,” accessed September 30, 2016, <https://doctrine.af.mil/DTM/dtmcombatsupport.htm>.

⁶ Ibid.

⁷ Ibid.

⁸ Ibid.

⁹ “Air Force Instruction 21-101” (www.e-publishing.af.mil, May 21, 2015), 10, http://static.e-publishing.af.mil/production/1/af_a4/publication/afi21-101/afi21-101.pdf.

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¹² Major Curt A. Van De Walle, “Back to the Future: Does History Support the Expeditionary Air Force Concept,” Research (Maxwell Air Force Base, Alabama: Air Command and Staff College, April 2000), 14–16.

¹³ Major Brent Borchers, “U.S. ARMY AIR FORCES LOGISTICS IN THE SOUTHWEST PACIFIC DURING WORLD WAR II,” Research (THE SCHOOL OF ADVANCED AIR AND SPACE STUDIES, June 2010), 49–50.

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- ²⁷ *Ibid.*, 68.
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